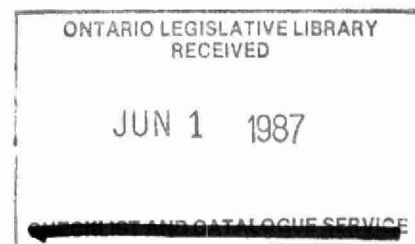


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AIR QUALITY ASSESSMENT  
THUNDER BAY TERMINALS LIMITED  
THUNDER BAY  
1980



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ONTARIO MINISTRY OF THE ENVIRONMENT  
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## INTRODUCTION

Since 1975, the Ontario Ministry of the Environment has undertaken pre- and post-operational air quality investigations in the vicinity of a coal storage and trans-shipment facility operated by Thunder Bay Terminals Limited in Thunder Bay.

Results of studies from 1975 to 1979 were presented in earlier reports (1, 2, 3, 4, 5, 6). The data showed that levels of dustfall and suspended particulate matter usually complied with Ontario's air quality objectives at all sampling locations around the project site. Levels of several chemical elements were also found to be normal in local vegetation and soil.

In 1980, three new dustfall monitoring sites were established on the property of Thunder Bay Terminals Limited, while four of the five Ontario Hydro sites were terminated because of dust interference from construction activities. Measurement of wind direction frequencies and maximum wind speeds commenced at Thunder Bay Terminals. A further snow sampling survey was also conducted, but no vegetation or soil samples were collected.

## SNOW SAMPLING

Duplicate samples of snow were collected on February 28, 1980, from 17 sites near the Thunder Bay Terminals Ltd. coal piles (Figure 1), and from two control locations remote from the source under investigation. A detailed description of the sampling method appeared in a previous report (6). Snow melt-water collected from each site was measured for pH and conductivity, and analyzed for aluminum, arsenic, carbon and iron.

Analytical results are summarized in Table 1. Levels of aluminum, iron, total carbon, suspended solids and pH were, as in 1979, much higher near the coal piles than those at the control sites. Conductivity and arsenic were normal at all sample sites. All elevated readings were restricted to the immediate vicinity of the coal storage and handling area and decreased rapidly with

increasing distance from this zone. The distribution pattern for total carbon, shown in Figure 2, was similar to that for aluminum, iron, suspended solids and pH.

As in 1979, strong correlation coefficients were found between aluminum and total carbon ( $r=0.89$ ), and between suspended solids and total carbon ( $r=0.94$ ). These relationships show that the suspended solids were almost entirely composed of carbon and that all the aluminum in snow was associated with the carbon.

Coarse and fine coal particles were conspicuous in snow at sites 5, 6, 7, 8, 9, 12, 14, 15, 16, and 17. Heavy deposition of this material was observed near the coal piles, with decreasing amounts up to a distance of approximately 350 m (metres).

## AIR QUALITY MONITORING

### DUSTFALL

Dustfall, comprising particulate matter which settles out from the air by gravity, was measured at the sites shown in Figure 3. Seven of the nine monitoring locations belonged to a network operated by V. B. Cook Company Limited, project managers for Thunder Bay Terminals Limited. Sites 9 (Kam Boating Club) and 10 (McKellar Hospital) were part of the Ministry of the Environment air quality monitoring network for Thunder Bay. A description of the dustfall measurement method appears in the report for 1977 (4).

Dustfall levels for 1980 are presented in Table 2. Except for one month at one site (August, Shell Oil Terminal), monthly and average annual dustfall complied with Ontario objectives at all locations off Thunder Bay Terminals and Ontario Hydro property.

A comparison between average dustfall from 1976 to 1980 (Table 3) shows that there was no increase in dustfall at any of the four sites off Thunder Bay Terminals property following the

commissioning of the new coal-handling facility in June, 1978. The cause of elevated readings during some months at the monitoring locations on company property has not been conclusively determined, but coal dust is suspected as at least a partial contributor. Future samples of high dustfall will be examined microscopically to verify this assumption.

#### SUSPENDED PARTICULATE MATTER

Suspended particulate matter comprises dust particles of small size and is measured with a high-volume air sampler for a 24-hour period every sixth day. Details of the sampling method are given in our 1977 report (4).

The 1980 data is summarized in Table 4 for three Thunder Bay Terminals sites (sites 1-3) and the Ministry of the Environment site (site 10). Total suspended particulate matter exceeded the Ontario objective of  $120 \mu\text{g}/\text{m}^3$  (micrograms of particulate matter per cubic metre of air) on only two occasions at the sewage treatment plant, Shell Oil Terminal and McKellar Hospital, and three times at Thunder Bay Terminals for 61 sampling dates during the year. The provincial objective of  $60 \mu\text{g}/\text{m}^3$ , annual geometric mean, was met at all sites in 1980, as it was in previous years. A 5-year summary of annual average suspended particulate matter concentrations, in Table 5, shows no evidence of significant change between the pre-operational and post-operational situation in the vicinity of Thunder Bay Terminals Limited.

#### CONCLUSIONS

Air quality studies during the second full year of operation at Thunder Bay Terminals Limited showed that the deposition of coal dust was restricted to the immediate vicinity of the coal storage area and did not extend off company property. Similarly, levels of suspended particulate matter showed no increase from concentrations recorded before coal shipments began.

Measurement of dustfall and suspended particulate matter will continue to ensure compliance with Ontario air quality regulations. Additional meteorological data will also be collected. Since air quality objectives are being achieved at all off-property sites, no further sampling of vegetation, soil, or snow is planned, and no additional abatement requirements will be imposed on the company at present.

#### ACKNOWLEDGEMENT

The Ministry of the Environment is grateful to V. B. Cook Company Limited, project managers for Thunder Bay Terminals Limited, for providing data on dustfall, suspended particulate matter, and wind records.

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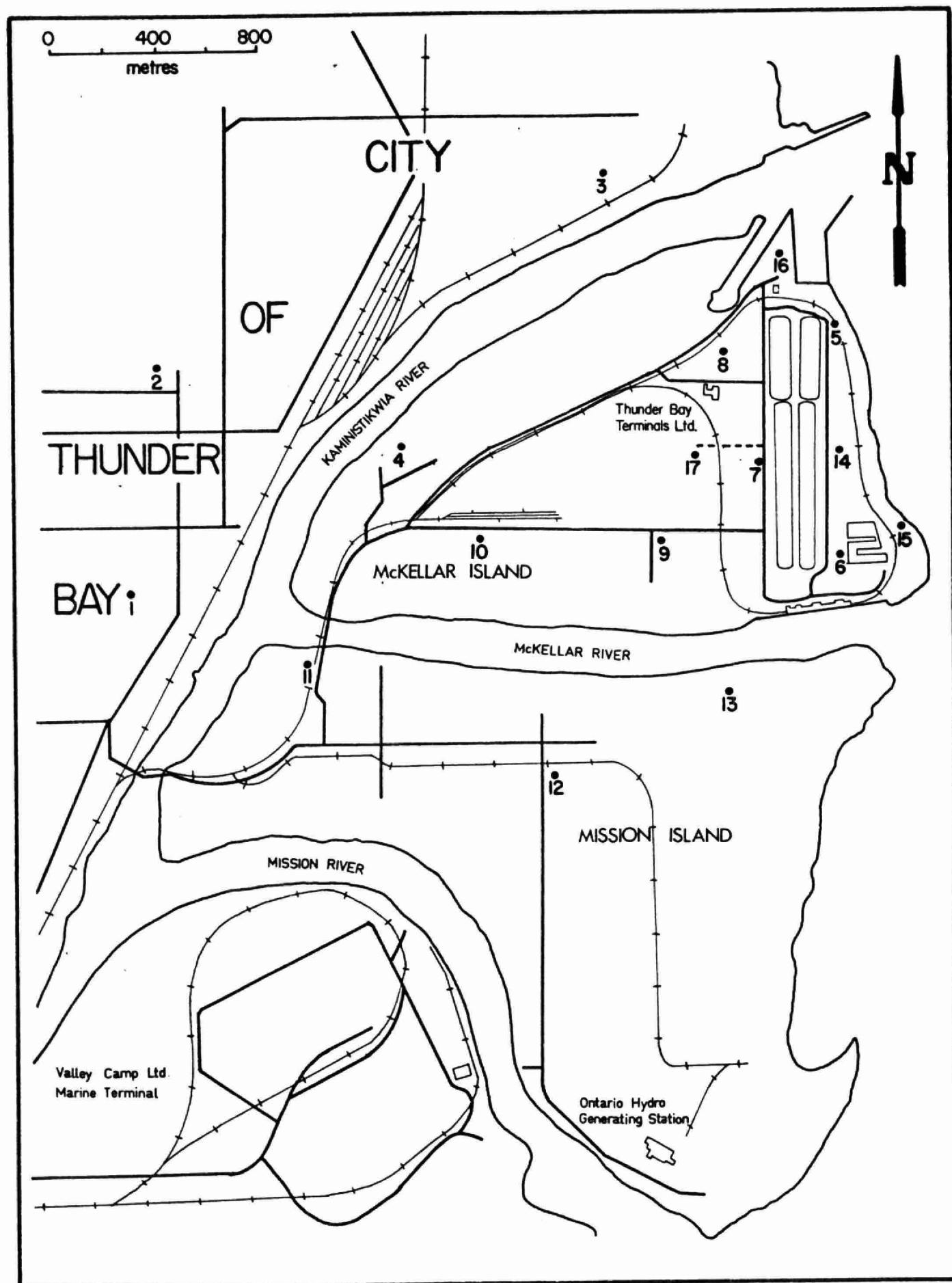


Figure 1. Snow sampling sites, February 28, 1980.



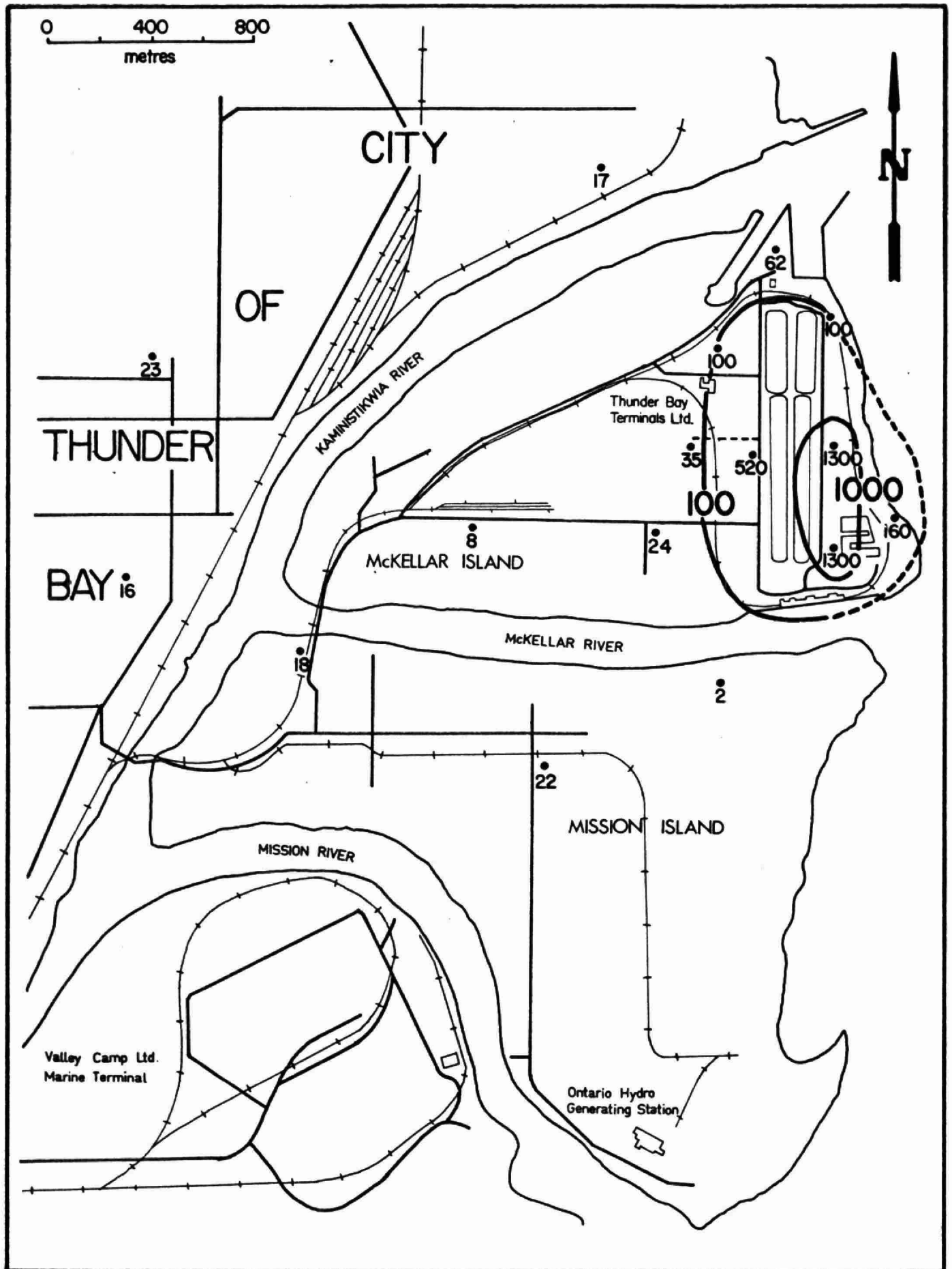


Figure 2. Levels of total carbon (mg/l) in snow, February 28, 1980.

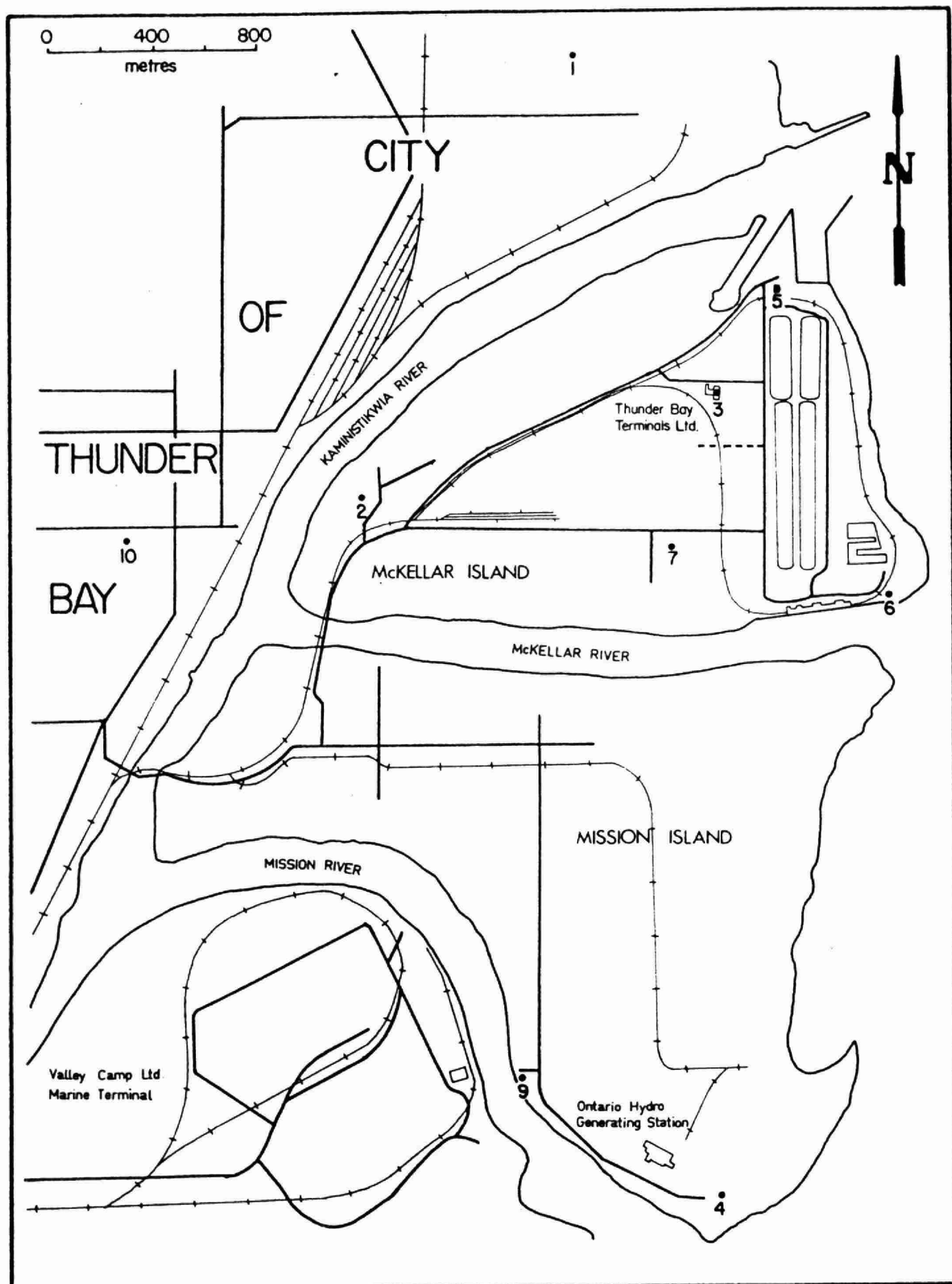


Figure 3. Air quality monitoring sites, 1980.

TABLE 1. Levels of aluminum, arsenic, carbon, iron, suspended solids, conductivity and pH in snow collected in the vicinity of Thunder Bay Terminals Limited, Thunder Bay, on February 28, 1980.

Station	Aluminum (mg/l)	Arsenic (µg/l)	Total carbon (mg/l)	Iron (mg/l)	Suspended solids (mg/l)	Conductivity (µmhos/cm)	pH
1	1	4	16	4	72	56	5.7
2	3	2	23	8	130	58	5.1
3	1	2	17	2	65	12	5.0
4	<1	2	--	3	28	20	5.2
5	10	9	100	16	430	47	7.3
6	48	12	1300	39	4200	73	8.6
7	16	4	520	11	1200	40	8.6
8	3	6	100	2	200	30	6.8
9	1	2	24	2	110	17	7.0
10	<1	2	8	2	42	16	5.8
11	<1	2	18	4	68	20	6.3
12	3	6	22	12	130	36	6.3
13	<1	4	2	3	85	18	6.0
14	20	8	1300	17	2200	41	8.7
15	10	4	160	10	670	38	7.5
16	1	2	62	2	70	16	6.4
17	2	2	35	5	110	20	7.0
Controls	<1	<1	4	<1	18	51	4.8
Normal background	<1	<10		<1			

TABLE 2. Dustfall (g/m<sup>2</sup>/30 days) in the vicinity of Thunder Bay Terminals and Ontario Hydro, 1980.

Site	Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1	Sewage Treatment Plant	1.1	0.9	1.7	1.3	0.9	2.2	3.6	6.4	6.1	2.9	1.3	1.9	2.5
2	Shell Oil Terminal	2.2	1.4	3.4	0.4	4.9	2.6	3.8	<u>19.2</u>	5.8	4.1	1.5	1.8	4.2
3	Thunder Bay Terminals	1.0	2.0	3.5	2.8	3.5	4.0	3.5	<u>26.2</u>	6.4	4.1	1.4	3.6	<u>5.2</u>
4	Ontario Hydro	2.6	2.2	1.9	<u>8.6</u>	<u>7.3</u>	<u>8.9</u>	<u>11.0</u>	<u>10.6</u>	3.4	<u>9.8</u>	5.6	<u>10.1</u>	<u>6.8</u>
5	Thunder Bay Terminals	3.8	0.8	2.7	2.8	2.8	3.1	3.2	6.8	<u>12.2</u>	4.6	2.4	1.6	3.9
6	Thunder Bay Terminals	<u>16.5</u>	4.0	2.1	<u>32.0</u>	3.7	<u>7.6</u>	<u>14.6</u>	<u>9.4</u>	2.1	2.6	6.8	0.8	<u>8.5</u>
7	Thunder Bay Terminals	1.0	1.8	2.3	7.0	<u>12.0</u>	<u>44.9</u>	4.1	<u>11.9</u>	4.6	3.7	0.7	0.8	<u>7.9</u>
9	Kam Boating Club	-	0.6	1.4	1.7	3.1	2.5	4.4	4.6	4.3	2.0	1.3	1.3	2.5
10	McKellar Hospital	1.4	5.5	3.9	4.6	5.0	4.9	6.9	4.1	5.6	2.9	1.0	2.1	4.0

<sup>a</sup>Values exceeding maximum acceptable levels of 7.0 (monthly) or 4.6 (annual average) are underlined.

TABLE 3. Average dustfall (g/m<sup>2</sup>/30 days) in the vicinity of Thunder Bay Terminals Limited and Ontario Hydro, 1976-79.

Site	Location	1976	1977	1978	1979	1980
1	Sewage Treatment Plant	3.2	4.4	3.2	2.8	2.5
2	Shell Oil Terminal	4.2	<u>8.4</u> <sup>a</sup>	<u>5.1</u>	3.7	4.2
3	Thunder Bay Terminals	4.2	4.2	2.7	2.7	<u>5.2</u>
4	Ontario Hydro (SE)	4.2	<u>11.5</u>	<u>7.4</u>	<u>5.9</u>	<u>6.8</u>
5	Ontario Hydro (SW)	<u>11.2</u>	<u>24.1</u>	<u>15.5</u>	<u>29.9</u> <sup>b</sup>	
6	Ontario Hydro (NW)	<u>5.2</u>	<u>34.8</u>	<u>9.6</u>	<u>37.8</u> <sup>b</sup>	
7	Ontario Hydro (NE)	<u>13.3</u>	<u>14.6</u>	<u>13.0</u>	<u>12.5</u> <sup>b</sup>	
8	Ontario Hydro (N)	<u>7.0</u>	<u>5.2</u>	<u>5.6</u>	4.4 <sup>b</sup>	
5	Thunder Bay Terminals					3.9 <sup>c</sup>
6	Thunder Bay Terminals					<u>8.5</u> <sup>c</sup>
7	Thunder Bay Terminals					<u>7.9</u> <sup>c</sup>
9	Kam Boating Club	<u>5.6</u>	4.6	4.3	4.2	2.5
10	McKellar Hospital	3.5	<u>5.0</u>	3.8	3.8	4.0

<sup>a</sup>Values exceeding maximum acceptable levels of 4.6 are underlined.

<sup>b</sup>Ontario Hydro sites terminated December 31, 1979.

<sup>c</sup>Thunder Bay Terminal Ltd. sites activated January 1, 1980.

TABLE 4. Concentrations of total suspended particulate matter ( $\mu\text{g}/\text{m}^3$ ) in the vicinity of Thunder Bay Terminals Limited, 1980.

Date	Sampling site				Date	Sampling Site			
	1	2	3	10		1	2	3	10
Jan 4	42	32	7	-	Jul 2	43	67	45	89
10	22	20	5	-	8	51	61	53	97
16	27	17	28	34	14	35	72	96	-
22	24	28	20	81	20	30	40	36	39
28	15	20	32	40	26	55	67	12	-
Feb 3	34	50	62	60	Aug 1	58	89	56	80
9	44	66	55	85	7	75	91	74	55
15	19	44	30	55	13	36	36	31	40
21	11	19	-	71	19	34	31	26	59
27	-	15	27	60	25	46	56	42	102
Mar 4	14	32	24	39	31	20	24	23	27
10	25	38	35	-	Sep 6	30	40	40	32
16	14	21	30	-	12	8	54	29	19
22	27	39	37	34	18	9	17	14	9
28	30	44	27	66	24	12	36	42	54
Apr 3	73	129 <sup>a</sup>	116	143	30	9	35	30	26
9	34	<u>28</u>	22	<u>26</u>	Oct 6	38	43	38	56
15	45	60	63	76	12	6	13	13	11
21	30	66	91	53	18	7	14	7	-
27	28	33	55	19	24	8	14	14	9
May 3	86	12	173	97	30	35	65	40	65
9	27	47	<u>40</u>	51	Nov 5	18	30	28	65
15	67	74	55	67	11	31	31	25	104
21	175	119	127	152	17	39	40	49	19
27	<u>23</u>	28	<u>42</u>	<u>60</u>	23	44	37	29	19
Jun 2	26	42	21	51	29	18	24	22	18
8	27	47	32	-	Dec 5	25	26	32	39
14	21	30	22	-	11	19	21	22	22
20	74	109	67	30	17	15	16	10	26
26	<u>130</u>	<u>133</u>	<u>134</u>	104	23	17	15	31	19
					29	40	15	15	31
Annual geometric means:						28	36	33	44

<sup>a</sup>Values exceeding maximum acceptable level of  $120 \mu\text{g}/\text{m}^3$  (24-hour average) are underlined.

TABLE 5. Annual geometric means of total suspended particulate matter ( $\mu\text{g}/\text{m}^3$ ) in the vicinity of Thunder Bay Terminals Limited, 1976-80.

Site	Location	1976	1977	1978	1979	1980
1	Sewage Treatment Plant	41	31	27	30	28
2	Shell Oil Terminal	<u>61</u> <sup>a</sup>	60	48	41	36
3	Thunder Bay Terminals	47	33	34	33	33
10	McKellar Hospital	49	36	44	51	44

<sup>a</sup>Values exceeding maximum acceptable levels of  $60 \mu\text{g}/\text{m}^3$  (annual geometric mean) are underlined.

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